

The Elderly Type 2 Diabetic Patient: Special Considerations

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Diabetes mellitus is a common disease in older people, with almost 50 % of Type 2 diabetic patients being over 60 years of age; despite this, half of older people with frank diabetes are not diagnosed. While insulin resistance is common in older people, large numbers also have impaired insulin secretion. Age, body habitus and physical activity all play a role in the pathogenesis of hyperglycaemia associated with diabetes mellitus. Leptin levels relate to insulin resistance in older people and amylin secretion is associated with delayed return of glucose levels to baseline. Depression, impaired cognitive function, and lack of recognition of thirst and subsequent dehydration are important factors to be taken into account in the management of older diabetic patients, who may also have impaired physical function, an increased rate of injurious falls, and increased prevalence of pressure ulcers, amputations and tuberculosis. Hyperglycaemia can result in a decreased pain threshold and incontinence. Dietary management plays less of a role in older diabetic patients but exercise, with a particular emphasis on balance and stability, is an important component of the management and treatment of older diabetic patients. The use of metformin as a treatment should be avoided in patients over 80 years of age because of declining kidney function. Insulin therapy is an option but as hypoglycaemia is related to advancing age, patients should be monitored carefully for the development of hypoglycaemia. Care providers also play an important role in the management of older people with diabetes mellitus. Glycaemic control can be obtained with minimal side-effects in most older diabetics including those patients in nursing homes. © 1998 John Wiley & Sons, Ltd.

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Introduction

The prevalence of diabetes mellitus and impaired glucose tolerance increases with age.¹ Marked variations in the prevalence of diabetes occur in older people in different countries (Figure 1) although the high prevalence of undiagnosed diabetes may explain these findings.^{1–5} The highest prevalence of diabetes in people aged 65–74 years is reported to be 40 % among the Pima Native Americans.² Insufficient data are available on the prevalence of diabetes in people over 74 years of age. In view of the premature deaths associated with diabetes and the decline in body weight and fat seen beyond the age of 75 years,⁷ it is possible that a decline in both the prevalence and the incidence of diabetes occurs in advanced age. In the USA, people with diabetes over the age of 55 years are more likely to be in nursing homes (18.3 %) compared with a prevalence of diabetes in the general population over 55 years of 12.6 %.⁸ In nursing homes, people with diabetes tend to be younger and are more likely to be Black than non-diabetic residents.

Despite the fact that approximately 50 % of people

with diabetes in the USA are over 60 years of age, little attention has been paid to this subgroup of patients.⁹ Older and middle-aged diabetic patients are more likely to have insulin resistance and Type 2 diabetes than Type 1 diabetes (approximately 10 % of the diabetic population). However, older Type 2 diabetic patients tend to be less obese and are more likely to have significantly impaired insulin secretion than middle-aged Type 2 diabetic patients.¹⁰ Furthermore, ageing appears to interact with hyperglycaemia to accelerate the onset of late diabetic complications, such as retinopathy and nephropathy, with their onset occurring within 5 years of the diagnosis of diabetes.¹¹ Older people with diabetes (over the age of 60 years or living in nursing homes) are more likely to develop hyperosmolar non-ketotic coma and have worse outcomes, e.g. higher mortality than middle-aged people with diabetes.¹²

Diabetes continues to shorten life in older people. Sinclair *et al.*,¹³ using meta-analysis techniques, found that diabetes increased age-specific mortality regardless of age at onset. Diabetes is associated with a greater disease burden at all ages, even in people in nursing homes who have diabetes.¹⁴ People with diabetes report poorer functional status than those who do not have diabetes.^{15,16}

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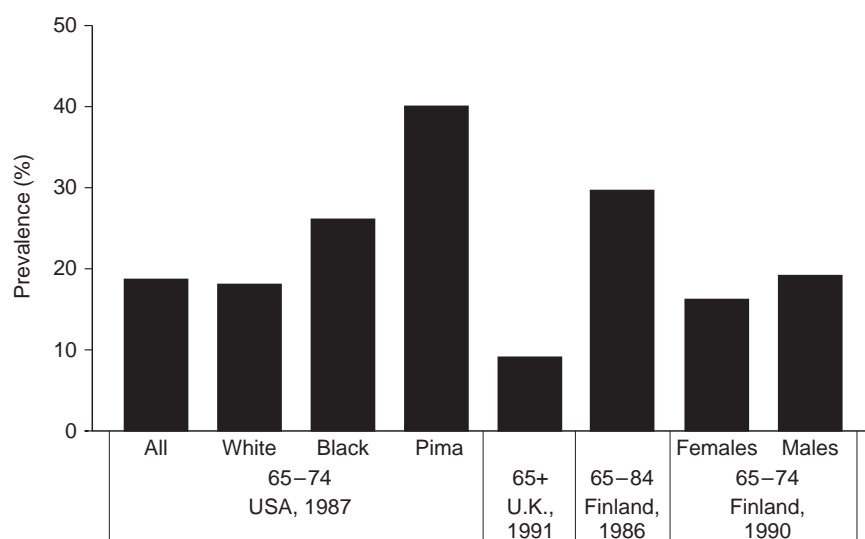


Figure 1. Prevalence of diabetes in older people¹⁻⁵

People with diabetes develop disorders associated with ageing earlier than older people who do not have diabetes, e.g. increased collagen cross-linking, increased basement membrane thickening, and atherosclerosis and cataracts.¹⁷ Evidence is increasing that good control of diabetes in older people improves their quality of life and long-term outcomes.¹⁸⁻²³

Unique Aspects of Diabetes in Older People

Many studies have shown that hyperglycaemia is associated with a deterioration in cognitive function in older people.²⁴⁻²⁶ Animal studies have demonstrated that the cause of cognitive deterioration is hyperglycaemia *per se* rather than other effects of diabetes.²⁷ In older humans, restoration of circulating glucose levels to normal results in restoration of cognitive function.^{28,29} The deterioration in cognitive function (both memory and processing) is associated with decreased compliance with treatment in older people with diabetes.³⁰

Depression occurs more commonly in people with diabetes than in non-diabetic people, particularly in those patients with complications.³¹ In our study of older people with diabetes, we found that the presence of depression was strongly associated with hospitalization and mortality.³² Depression needs to be treated aggressively in older people with diabetes to improve compliance and reduce the risk of suicide. Antidepressants with increased anticholinergic activity, e.g. imipramine, amitriptyline and paroxetine, should be avoided because they may interact with the autonomic dysfunction that is present in many older diabetic patients to produce orthostatic hypertension and urinary retention. In diabetes, desipramine, nortriptyline and sertraline appear to be the most appropriate antidepressants to use.

Pressure ulcers occur more commonly in people with diabetes³³ and, although the reasons for this are unclear,

poor tissue blood flow may be a contributory factor. In addition, diabetic patients tend to leach zinc in the urine³⁴ as a result of elevated glucose levels.³⁵ Loss of zinc leads to zinc deficiency, which is associated with poor wound healing. Older persons with pressure or vascular ulcers combined with zinc deficiency should receive supplementary zinc treatment (220 mg zinc sulphate three times daily). Two-thirds of all amputations occur in people over 65 years of age and two-thirds of these occur in people with diabetes.³⁶ Alterations in blood flow to the microvascular structures of the feet, as well as changes in autonomic nervous system function, are the major causative factors in the pathogenesis of foot ulcers, and eventually infection and amputation. Careful attention to the feet is of paramount importance in older people with diabetes. Appropriate foot wear, applications of lipid-based lotions to dry feet and early intervention when foot lesions occur are all key factors in the prevention of amputations. Careful attention to the development of peripheral vascular disease and its appropriate management also plays an important role in the prevention of amputations.

Diabetic patients experience pain more frequently than people with other chronic conditions³⁷ and older diabetic patients have a decreased pain threshold despite having early signs of peripheral neuropathy. The reduced pain threshold in diabetic patients may be a direct consequence of hyperglycaemia because infusion of glucose to normal individuals decreases the ability to tolerate pain.³⁸ Results from experimental studies suggest that the lowering of the pain threshold may be caused by glucose blocking the capacity of beta-endorphin to combine with its receptor.^{39,40}

Older diabetic patients report reduced physical function compared with other older people^{15,16} as a result of multifactorial impairment that includes visual deterioration, peripheral neuropathy and balance problems. Functional impairment is associated with increased falls

and an increase in injuries,¹⁵ and therefore aggressive counselling of diabetic patients about environmental hazards is warranted. All diabetic patients should be taught balance exercises to decrease the chances of falling or injury. The FICSIT study (Frailty and Injuries: Co-operative Studies of Intervention Techniques) demonstrated that balance exercises, particularly in the form of Tai Chi, are the most successful preventive measure to decrease falls.⁴¹

Elevated glucose levels result in osmotic diuresis, which is associated with the development of incontinence, similar to that seen in older people taking diuretics. The hyperosmolar diuresis can also lead to nocturia and disturbed sleep. Older people with elevated glucose levels are at increased risk for developing atypical infections. In particular, they have an increased risk of developing tuberculosis,⁴² partly as a result of memory T-cell defects that occur with ageing. The risk of developing dehydration is also increased in older people⁴³ as a result of μ -opioid thirst drive failure.⁴⁴ Thus, when older diabetic people develop an osmotic diuresis, they often do not recognize that they are thirsty and become dehydrated and develop hyperosmolar coma.

Diabetes produces a decrease in testosterone levels in men that is secondary to a failure of the hypothalamic-pituitary axis.⁴⁵ Low testosterone levels are often seen in older diabetic people, which accelerate the onset of the androgen deficiency in aging men (ADAM) syndrome.⁴⁶ The ADAM syndrome is associated with decreased strength, cognitive abnormalities, decreased libido and poor quality of penile erections. People with diabetes are also at an increased risk of developing impotence secondary to vascular disease, autonomic neuropathy and zinc deficiency.

Increased osmolality in the vitreous humour, increased cataract formation and increased propensity to develop glaucoma and retinopathy all interact to increase the visual acuity problems seen in the older diabetic person. Older people have declining glomerular filtration rates, which can be accelerated by diabetes, resulting in premature renal failure. The unique aspects of diabetes in older people and the appropriate preventive approaches are summarized in Table 1.

Differences in Diabetes Management in Older People

Numerous factors, such as decreased thirst perception, decreased exercise tolerance, deteriorating vision, arthritis, cognitive problems, depression and social problems, make the management of older people with diabetes extremely difficult.

Exercise is the fundamental therapy for diabetes in older people, but should be undertaken in moderation and not in excess. Endurance exercises are only one component of the complete exercise prescription; strengthening, posture, flexibility and balance exercises are key to maintaining function and preventing falls.

Table 1 Unique aspects of diabetes mellitus in the elderly

Syndrome	Preventive measures
Cognitive impairment	Control hyperglycaemia Provide written instructions
Depression/suicide	Screen using Geriatric Depression Scale Treat depression
Pressure ulcers	Control hyperglycaemia Consider zinc deficiency
Amputations	Pay careful attention to foot care
Decreased pain threshold	Control hyperglycaemia
Functional impairment	Control hyperglycaemia
Falls	Balance exercises Monitor orthostatic blood pressure
Incontinence	Control hyperglycaemia
Dehydration	Drink fluids regularly Control hyperglycaemia
Tuberculosis	Control hyperglycaemia
Hypogonadism	Control hyperglycaemia

Little evidence exists to support aggressive dietary management in older people. Diabetic diets have been shown to make no difference to glycaemic control in nursing home residents⁴⁷ and special diets in nursing homes have been associated with the development of protein-energy malnutrition.⁴⁸ Addition of dietary fibre will, in some instances, improve the glycaemic response to a meal. Most older people with diabetes are not dramatically overweight (although approximately one-third are) and therefore weight-reducing diets should usually be avoided.

Many oral hypoglycaemic agents are now available for the management of older people with Type 2 diabetes but sulphonylureas remain the mainstay of treatment. In general, when improved glycaemic control is obtained, sulphonylureas may produce hypoglycaemia, including severe hypoglycaemia.⁴⁹ Tolbutamide remains a useful agent in older people with the early stages of diabetes (7–10 mmol L⁻¹). The long half-life of chlorpropamide and its propensity to produce hyponatraemia means that it should be avoided in the very old (over 70 years of age). In one study, results have shown that the incidence of chlorpropamide-associated hyponatraemia was 7.1 % of the study population.^{50,51}

Metformin is a safe drug in the young old (up to age 70 years) who have no contraindications to its use. The rate of lactic acidosis is 3–5 cases per 100 000 patient years. In the USA, post-marketing surveillance showed that 17 % of patients diagnosed with lactic acidosis were over 80 years of age. Avoidance of metformin use in people over 80 years of age or performing a creatinine clearance test appear to be appropriate recommendations. Metformin produces anorexia⁵² and, because older people are at high risk of developing protein-energy malnutrition, careful monitoring of weight loss and serum albumin levels are warranted.⁵³

Troglitazone is the first of the thiazolidinediones to be available in the USA for the management of diabetes.

In our hands troglitazone has been an excellent, safe drug^{54–58} for the treatment of mild diabetes (fasting glucose 7–12 mmol·l⁻¹) in older people without liver dysfunction. In the original clinical trials of troglitazone, 22% of the patients were ≥ 65 years of age and the drug showed a similar efficacy and safety profile in this population.⁵⁹ We believe troglitazone is the treatment of choice in nursing home residents because of the lack of hypoglycaemia. Liver dysfunction associated with troglitazone appears to be rare.⁶⁰ Liver function tests need to be carried out monthly for the first 6 months in patients on troglitazone; troglitazone should be avoided in persons with liver dysfunction. New thiazolidinediones, such as rosiglitazone, will be available shortly when their usefulness in older persons may be evaluated. Our experience of using alpha-glucosidase inhibitors in older people is limited. The gastrointestinal side-effects associated with the use of alpha-glucosidase inhibitors in older people make this class of drug difficult to use. However, the lack of hypoglycaemia that occurs when alpha-glucosidase inhibitors are used makes these drugs potentially useful.

Repaglinide is a fast acting prandial glucose regulator, the first of a new class of oral hypoglycaemic agents (carbamoylmethyl benzoic acid [CMBA] derivative)^{61,62} that has been released recently in the USA. The compound is absorbed rapidly and causes a unique physiological insulin-release profile. Repaglinide is metabolized mainly by the liver and excreted via the bile, thus making it suitable for use in patients with mild to moderate renal impairment.⁶² As a result of the short duration of action of repaglinide, the treatment should be tailored to the patient's meal schedule, i.e. the dosage should be prandial, and if a meal is skipped, the corresponding dose should also be omitted.^{63,64} Prandial dosing may reduce the risk of hypoglycaemic events in Type 2 diabetic patients who have a flexible lifestyle. At present, experience with this drug in older patients is limited.

Insulin therapy should not be avoided in older Type 2 diabetic patients with unacceptable glycaemic control. As a result of the progressive decline in β -cell function with duration of the disease, insulin treatment may be required in many patients. However, hypoglycaemia is related to advancing age and patients should be monitored carefully for the development of hypoglycaemic symptoms. We have found that twice-daily injections of insulin are the approach of choice. The type of insulin used is NPH and regular insulin, or fixed ratios (e.g. 70/30) depending on the individual needs of the patient and their cognitive states. In our experience, troglitazone has been useful as an adjunct to insulin when older patients are having difficulty with large fluctuations in glucose throughout the day.

In the management of older diabetic patients it is important to pay attention to the care providers who will be monitoring insulin dose and determining glucose levels. A diabetes education programme that included

care providers was shown to improve glycaemic control and enhance quality of life for diabetic patients.⁶⁵

In older diabetic patients, regulation of blood pressure should aim to maintain systolic pressure below 160 mmHg and diastolic below 95 mmHg but, because of the high propensity of the older patient to develop orthostasis, which can be compounded by diabetic autonomic neuropathy, blood pressure should always be measured in the standing as well as sitting or supine position. Furthermore, because of the high prevalence of coronary artery disease in older diabetic patients, it would appear prudent to use an aspirin a day in men and vitamin E in women to prevent platelet adherence.⁶⁶

Conclusion

The management of Type 2 diabetes in older people is extremely challenging. Evidence is increasing that suggests that improved glycaemic control reduces the progression of retinopathy,⁶⁷ and decreases coronary artery disease events and mortality.⁶⁸ Through decreased morbidity, improved glycaemic control also enhances quality of life. The availability of multiple treatment modalities has improved the clinicians' ability to regulate glucose without exposing patients to excessive hypoglycaemia. Insulin therapy should not be avoided in older people when it is necessary to obtain adequate glycaemic control. Physicians should pay particular attention to the presence of cognitive dysfunction and depression in the older diabetic patient and education programmes should focus on the care provider as well as the patient when obtaining high-quality outcomes is the aim of diabetes care. Finally, physicians need to increase their awareness of the need to diagnose and treat diabetes in older people. The publication of the United Kingdom Prospective Diabetes Study further supports this contention, and additionally highlights the need for adequate blood pressure control, at least in older people.

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